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ABSTRACT

The Texas Educational Assessment of Minimum Skills (TEAMS) was developed by the Texas Education Agency (TEA), in response to Texas House Bill 72 (1984), which mandated a new basic skills assessment program for mathematics, reading, and writing at grades 1, 3, 5, 7, 9 and 11. This document is one in a series of Instructional Strategies Guides designed to familiarize Texas educators with the types of strategies employed in assessing learner mastery of TEAMS objectives and to provide suggested instructional activities that can be used to promote mastery of those objectives. This guide focuses on the TEAMS mathematics objectives for grade 3. It provides a detailed description of the test items used to measure each mathematics objective. The 11 objectives are subsumed under five skill areas: (1) number concepts (number sequence, place value, number patterns, expanded notation, fractional parts); (2) computation (addition, subtraction); (3) problem solving (addition word problems, subtraction word problems); (4) measurement (units of measure); and (5) geometry (geometric shapes). The following information is provided for each objective: (1) a description of the objective; (2) a sample item; (3) test questions; (4) answer choices; (5) answer analysis for sample item; (6) instructional emphases; and (7) possible instructional activities. (JAZ)

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INSTRUCTIONAL STRATEGIES GUIDE

MATHEMATICS

GRADE 3

TEXAS EDUCATION AGENCY

William B. Travis Building
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August 1986

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TEAMS INSTRUCTIONAL STRATEGIES GUIDE

MATHEMATICS

GRADE 3

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INTRODUCTION

During 1980-1985 the Texas Education Agency (TEA) administered a criterion-referenced testing program, the Texas Assessment of Basic Skills (TABS). That program was designed to measure minimum skills in mathematics, reading, and writing at Grades 3, 5, and 9. In July 1984, under the provisions of House Bill 72, a new basic skills assessment program was mandated in mathematics, reading, and writing at Grades 1, 3, 5, 7, 9, and 11. In response, development of the Texas Educational Assessment of Minimum Skills (TEAMS) was instituted by TEA during the 1985-1986 school year.

School district personnel from across Texas participated in all aspects of the development of TEAMS. Basic skills objectives were selected after a thorough review of the State Board of Education Rules for Curriculum, GE4 450 01, (Essential Elements). Under TEA supervision measurement specifications and test items were developed for each objective. Statewide field testing was conducted to ensure the quality of test items. The State Board of Education then approved the TEAMS tests for administration.

Because of the significance of the TEAMS program, TEA is providing Texas educators with instructional strategies guides for all objectives measured on each TEAMS examination. These guides describe the TEAMS objectives as well as instructional considerations and activities that can be used to promote mastery of TEAMS objectives.

This instructional strategies guide focuses on the TEAMS mathematics objectives for Grade 3. It provides a detailed description of the test items used to measure each mathematics objective. In addition, a brief instructional analysis is provided for each objective as are instructional activities that can help students master the objective.

Texas educators will undoubtedly vary in the ways they wish to promote learner mastery of the TEAMS objectives. Thus, the instructional components of this guide are <u>not</u> intended to be prescriptive. Teachers should view suggested activities as potential approaches that lead to mastery of the TEAMS objectives.

<u>Components of the Instructional Strategies Guide</u>

Eleven TEAMS mathematics objectives are measured at the third grade level. These objectives are subsumed under one of five skill areas. The distribution of reading objectives by skill area is shown on the next page.

SKILL AREA	OBJECTIVE
Number Concepts	Number Sequence Place Value Number Patterns Expanded Notation Fractional Parts
Computation	Addition Subtraction
Problem Solving	Addition Word Problems Subtraction Word Problems
Measurement	Units of Measure
Geometry	Geometric Shapes

This guide provides the following information for each of the mathematics objectives included in the TEAMS Grade 3 test.

Description of the objective. This section provides a succinct overview of the objective's focus.

Sample item. An illustrative sample item follows the description of each objective. This item is consistent with the test specifications for the objective, hence is representative of the TEAMS items used to measure students' mastery of the objective.

Test questions. To provide a more detailed view of how each TEAMS objective is assessed, the next section provides a description of the test question. All of the Grade 3 mathematics items present a stimulus that precedes four answer choices.

Answer choices. The next section deals with the response to each multiple-choice test item. Important characteristics of the answer choices are described.

Answer analysis for sample item. An analysis of the answer choices from the sample item is then provided. This analysis explains why the correct answer is right and why the incorrect answers are wrong.

Instructional emphases. Considerations relevant to the design of instructional sequences for each TEAMS objective are described in this section. These instructional analyses are not intended to represent the only important points associated with instruction aimed at a particular objective. However, it is hoped that these discussions will stimulate educators' consideration of each objective.

Possible instructional activities. The final section discusses several instructional activities for the objective that Texas educators may wish to consider as they organize their instructional plans.

Use of the Instructional Strategies Guide

This TEAMS instructional strategies guide is designed to accomplish two goals. First, the guide enables Texas educators to become familiar with the types of assessment strategies employed to assess learner mastery of the TEAMS Grade 3 mathematics objectives. Educators who wish to learn more about how the TEAMS objectives are tested should consult the TEAMS objectives and measurement specifications available at cost from TEA. The level of detail provided in this instructional strategies guide should provide sufficient information for educators to design effective instructional sequences. Second, each instructional strategies guide provides suggestions for instructional strategies that can be used to promote mastery of TEAMS objectives.

The specific setting in which a given district chooses to provide instruction in the TEAMS objectives will influence the way in which the materials in this guide can be employed. The format of the guide permits flexible use.

General Nature of the Test Items

The TEAMS Grade 3 mathematics objectives are measured by multiple-choice items that present a problem followed by four answer choices, one of which is correct. The items, depending on the objective, present a pictorial model, a geometric figure, a numeric problem, or a word problem. The problems are similar to those that students encounter in school, at home, or in their community.

SKILL AREA: NUMBER CONCEPTS

The skill area of number concepts covers five objectives: number sequence, place value, number patterns, expanded notation, and fractional parts.

Objective 1: Arrange a group of three whole numbers from least to greatest or greatest to least.

This objective requires students to select the set of three whole numbers that is correctly ordered from least to greatest or from greatest to least.

Sample Item

Read the question. Mark your answer.

Which group below shows the three numbers in order from greatest to least?

○	99	70	123
○	99	123	70
○	123	99	70
○	123	70	99

Test Questions

1. A test item will ask the student, "Which group below shows the three numbers in order from least to greatest (or greatest to least)?"

Answer Choices

1. Each answer choice will be a list of three numbers. The list of numbers will not contain reversals (for example, 87 and 78). The numbers will not be larger than three digits and will contain no more than one zero.

2. All answer choices will be comprised of the same three numbers arranged in different orders.

3. The correct answer choice will be the set of three numbers that is correctly ordered in the specified direction (that is, from least to greatest or from greatest to least).

4. Incorrect answer choices will be sets of three numbers that do not follow sequentially from greatest to least or from least to greatest.

Answer Analysis for Sample Item

1. The first answer choice presents numbers in an incorrect sequence. The number 70 precedes the larger number 123 in this sequence. Thus, the three numbers are not correctly ordered from greatest to least.

2. The second answer choice also presents numbers in an incorrect sequence. The number 99 precedes the larger number 123 in this sequence. Again, the three numbers are not correctly ordered from greatest to least.

3. The third answer choice is the correct response. The three numbers are correctly ordered from greatest to least (that is, 123 is greater than 99, which is greater than 70).

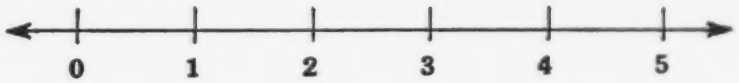
4. The fourth answer choice presents numbers in an incorrect sequence. The number 70 precedes the larger number 99. Again, the three numbers are not correctly ordered from greatest to least.

Instructional Emphases

To determine whether a sequence of numbers is ordered from least to greatest, tell students to begin with the first number in the sequence and compare it to the number to its right. Repeat this comparison for each number in the sequence. Each number should be less than the number to its right. If a number does not follow this pattern, the number sequence is not correctly ordered from least to greatest. For example, to determine whether the numbers 14, 83, 126 are ordered from least to greatest first compare 14 to 83. You may want to use place value blocks to show students that because there are 8 tens in 83 and only 1 ten in 14, 83 is larger than 14. Now compare 83 with 126. Because there is 1 hundred in 126 and none in 83, 126 is larger than 83. In this sequence the number to the right is always larger than the number to the left. Thus, the set is correctly ordered from least to greatest.

To determine whether a sequence of numbers is ordered from greatest to least, tell students to start with the first number in the sequence and see whether each number is greater than the number to its right. Again, this pattern should be true for the entire set of numbers. For example, to determine whether the numbers 258, 175, 179 are ordered from greatest to least, first compare 258 to 175. Demonstrate with place value blocks that because there are 2 hundreds in 258 and only 1 hundred in 175, 258 is greater than 175. Now compare 175 with 179. The hundreds and tens values are the same for both numbers. However, there are only 5 ones in 175 and 9 ones in 179. Thus, 175 is less than instead of greater than 179, the number to its right. This sequence is not ordered from greatest to least.

In summary, the process of identifying order in a sequence of numbers is simply to start with the first number and compare each number to the number to its right. However, success with ordering numbers requires an understanding of numbers and place values. Besides using place value blocks to reinforce the concept of ordering you may wish to consider using a number line. Show students that as you move to the right on the number line, the numbers are larger. As you move to the left on the number line, the numbers are smaller (for example 3 is less than 5).



Possible Instructional Activities

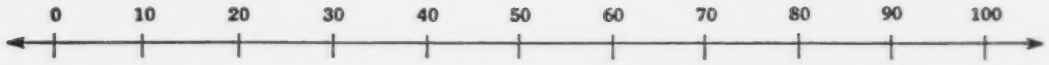
Flash

Divide the class into groups of four. Each group should be given, or should make, a set of about 30 flash cards with each card presenting a different number from 0 through 999. The activity begins by having the students shuffle the cards and place them facedown on a table or desk. Three of the students choose one card each. These three students then hold their flash cards in front of them. The fourth member of the group tells the three flash card holders to arrange themselves (and their numbers) in a line either from least to greatest or from greatest to least. After the students have arranged themselves correctly, they return the flash cards to the pile and pick up three more numbers. Students should rotate their duties so everyone gets a chance to direct the cardholders.

This activity could also be conducted in front of the whole class with a new group of 3 students selected each time to hold the cards.

What's My Line?

Draw a number line on the board with the following numbers identified:



Choose a number from 1 to 100 and write it down on a piece of scratch paper. Let students guess the number by asking questions such as "Is it less than 50?" and "Is it between 30 and 50?" Have a student add the number to the number line after it has been guessed. For variety, let students take turns choosing the numbers to be guessed.

Let's Compare

On a handout, present to students different categories of statistics involving one-, two-, and three-digit whole numbers. Statistics can come from several possible categories, such as those found in almanacs. Possible topics include:

-- heights of different types of trees
-- life spans of different animals
-- lengths of different rivers

The statistics within each category should be listed in random order. The students' task is to arrange the numbers from least to greatest or from greatest to least. A sample problem is shown below in which students must arrange the lengths of various rivers from greatest to least. This can be conducted as an individual seatwork activity or as a group activity that can be performed at the chalkboard.

Lengths of Different Rivers

River	Miles	Arrange the numbers from greatest to least
Albany	610	_____
Green	730	_____
Ohio	981	_____
Pecos	735	_____
White	720	_____

Objective 2: Identify the place value for a given digit of a three- or four-digit whole number.

This objective requires students to identify the place value of a specified digit or the numeral that is in a specified place in three- and four-digit numbers.

Sample Item

Read the question. Mark your answer.

In 1560, which numeral is in the ones place?

○ 5

○ 6

○ 0

○ 1

Test Questions

1. A test item will ask either:

   a. "In the number [a number], the [a digit] is in what place?" or

   b. "In [a number], which numeral is in the [a place value] place?"

2. The numbers will be three- or four-digit whole numbers. No digits will be repeated within a given number.

Answer Choices

1. Answer choices will be either:

   a. place values ranging from ones through thousands, or

   b. numerals that occupy different place values in the presented number.

2. Incorrect answer choices will be one of two types of errors:

   a. place values other than the one specified; or

   b. numerals that have a place value other than the one specified.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because 5 has a place value other than the one specified. The test question asks which numeral is in the ones place. The numeral 5 is in the hundreds place, not the ones place.

2. The second answer choice is also incorrect. The numeral 6 is in the tens place, not the ones place.

3. The third answer choice is the correct response. The numeral 0 is in the ones place in the number 1560.

4. The fourth answer choice is incorrect because the numeral 1 is in the thousands place.

Instructional Emphases

A review of the following information may help students master the concept of place value. Explain that ten digits are used to name numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). Only ten digits are used because numbers are grouped by tens. Discuss these facts:

1 one makes 1 one

10 ones make 1 ten

100 ones make → 10 tens or 1 hundred

1000 ones make → 100 tens or 10 hundreds or 1 thousand

You may want to demonstrate these facts with place value blocks or other manipulatives. The concept of place value may also be illustrated by using the following diagram.

	1000 Thousands	100 Hundreds	10 Tens	1 Ones
6183 →	6	1	8	3
9746 →	9	7	4	6
391 →	0	3	9	1
462 →	0	4	6	2

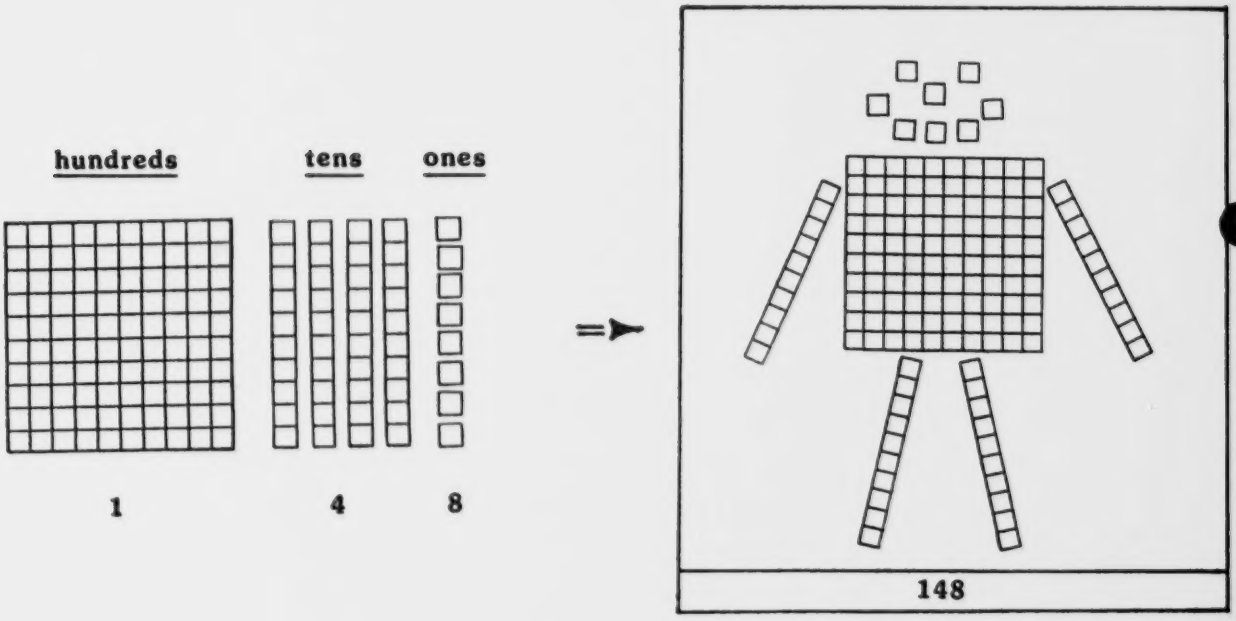
etc

Write three- and four-digit numbers in the diagram. Each number should be written slowly, digit by digit, in the spaces provided. Explain why each digit occupies the place it does. Students may actively participate by placing the appropriate number of paper strips or ice cream sticks in place value pocket charts at their desks.

Possible Instructional Activities

Picture This

Have students create "place value pictures" by using prepared sheets, strips, and individual boxes, as shown below.



Have students select a three-digit number and represent it by gluing the sheets, strips, and boxes onto plain construction paper to form any design that they wish. Tell students to write the number they have represented on the back of the paper. Students can then exchange pictures. Have each student identify the number represented in a classmate's picture and then see if it agrees with what is written on the back of the picture. If the numbers do not agree, have students determine which number is correct and why.

Place Value Practice

Distribute a sheet containing the numbers shown below. For class discussion, call upon students to answer questions such as the following:

(1) In the first number (6581) the 8 is in what place?

(2) In the second number (923) which numeral is in the hundreds place?

6	5	8	1
	9	2	3
7	1	8	5
6	2	1	7
	1	2	3
9	8	7	0

Be certain that the numbers do not contain any repetitions of digits as this may lead to confusion when asking questions of the first type.

Flashy Place Values

Various activities may be developed using flash cards. For one activity, write a three- or four-digit number on each card. Underline one digit in each number and record the correct answer on the back of the card. Have students identify the place that the underlined digit occupies. Students can either call out each answer or write the answers on a sheet of paper. This activity is also appropriate for pairs of students, who can use the flash cards to take turns testing each other on place value identification.

Alternatively, use cards with three- or four-digit numbers that do not have any underlined digits. On the back of each card, identify which numeral occupies each place. As you present each card, ask students what numeral is in either the ones, tens, hundreds, or thousands place. Once again, this activity is excellent for pairs of students who take turns being tested.

Objective 3: Complete a pattern involving multiples of 2, 3, 4, 5, or 10.

This objective requires students to select the set of numbers that correctly completes a given number pattern.

Sample Item

Complete the pattern. Mark your answer.

What numbers go in the next three spaces?

18, 20, 22, 24, __, __, __

- ○ 26, 30, 34
- ○ 28, 30, 32
- ○ 26, 28, 30
- ○ 19, 21, 23

Test Questions

1. A test item will direct students to identify "what numbers go in the next three spaces" of a given number pattern.

2. The four numbers that appear in the stem (the boxed series of numbers) will be consecutive multiples of 2, 3, 4, 5, or 10. Numbers will be presented in ascending order and will be whole numbers less than 100.

Answer Choices

1. Each answer choice will be a list of three numbers presented in ascending order. The numbers will be whole numbers and will not be larger than two digits.

2. The correct answer choice will be the set of numbers that correctly completes the given number pattern.

3. Incorrect answer choices are likely to result from one of two types of errors:

a. Incorrect Multiple: Three numbers in ascending order that use a different multiple from the numbers in the stem or that use an inconsistent multiple.

b. Incorrect Pattern: Three numbers between the values presented in the stem.

Answer Analysis for Sample Item

1. Answer choice A is incorrect due to an inconsistent multiple. The number 26 (position 1) follows the pattern using the given multiple, 2, but the numbers 30 and 34 (positions 2 and 3, respectively) continue the pattern using a multiple of 4, not 2.

2. Answer choice B is incorrect due to an inconsistent multiple. The number 28 (position 1) follows the stem based on a multiple of 4, whereas the numbers 30 and 32 (positions 2 and 3, respectively) continue the pattern using a multiple of 2.

3. Answer choice C is the correct response. The three numbers are of the correct multiple (2), and follow the stem in correct sequence.

4. Answer choice D is incorrect because of an incorrect pattern. The three numbers are of the same multiple (2), but fall between the values in the stem rather than following the sequential pattern.

Instructional Emphases

Explain to students that counting by multiples helps us to understand more about numbers and also helps us to use them more quickly and easily. Demonstrate counting by multiples with manipulatives such as sticks. For example, group sticks by twos and have students count aloud (2, 4, 6...) as you display each group. Introduce counting by threes, fours, fives, and tens in a similar manner.

For this objective, students must learn to identify and complete number patterns which result from counting by twos, threes, fours, fives, and tens. To help students with this skill, you may want to review a procedure such as the following:

> To determine the multiple used in a sequence (or pattern) of numbers, begin with the number farthest to the left in the pattern. Read the numbers from left to right. Starting at the very left, look at each number and compare it to the number on its right. The number to the right will always be larger than the number to

its left. To find out how much larger the number on the right is, subtract the number on the left from the number on the right. Try the next pair of adjacent numbers to check that you obtain the same result. The value you obtain is the multiple. That multiple must be added to the number on the far right to continue the pattern.

For example, 6, 9, 12, 15, ___, ___, ___

1. Subtract to find the multiple.

9 - 6 = 3
12 - 9 = 3
15 - 12 = 3 so, the multiple = 3

2. Add the multiple to fill in the missing numbers.

3 + 15 = 8
3 + 18 = 21
3 + 21 = 24

Thus, this pattern requires counting by threes. The three numbers that continue the pattern are 8, 21, and 24.

Demonstrate the same procedure using different number patterns presented on the board. For each pattern, have students identify what kind of counting is required (for example, counting by twos, threes, fours, fives, or tens). Then have students determine the next three numbers needed to continue each pattern.

Possible Instructional Activities

Pattern Boxes

Divide a large square into 25 boxes, with 5 boxes in each row and in each column. Number the boxes consecutively from 1 to 25, as shown below.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

Tell students to count by twos, starting with the number 2 on the chart, and lightly shade with a crayon every box containing numbers in the pattern (that is, 2, 4, 6,..., 24). Then students can use the key below to find a message by matching the numbers they colored with particular letters.

Message Key

1 = K	6 = E	11 = T	16 = M	21 = Q
2 = E	7 = O	12 = N	17 = Space	22 = R
3 = Space	8 = N	13 = L	18 = B	23 = D
4 = V	9 = T	14 = U	19 = D	24 = S
5 = A	10 = Space	15 = C	20 = E	25 = W

2-3-4-5-10

Present the following problems on the board or on handouts. Allow enough time for students to complete each problem at their desks, and then have volunteers complete the problems at the board.

Count by twos	a. Begin at 6. Count to 14. (answer: 6, 8, 10, 12, 14)	b. Begin at 10. Count to 18. (answer: 10, 12, 14, 16, 18)
Count by threes	a. Begin at 0. Count to 12. (0, 3, 6, 9, 12)	b. Begin at 6. Count to 18. (6, 9, 12, 15, 18)
Count by fours	a. Begin at 16. Count to 32. (16, 20, 24, 28, 32)	b. Begin at 12. Count to 28. (12, 16, 20, 24 28)
Count by fives	a. Begin at 25. Count to 45. (25, 30, 35, 40, 45)	b. Begin at 60. Count to 80. (60, 65, 70, 75, 80)
Count by tens	a. Begin at 50. Count to 90. (50, 60, 70, 80, 90)	b. Begin at 30. Count to 70. (30, 40, 50, 60, 70)

Sum Patterns

Present students with worksheets containing the following problems. Have students perform the addition problems and examine the sums in each row. Go over the answers in class and ask students to identify the number pattern they see in the sums of each row (row 1, multiples of 2; row 2, multiples of 3; row 3, multiples of 4; row 4, multiples of 10).

20	32	45	54	30
+42	+32	+21	+14	+40
14	20	20	12	23
+10	+ 7	+10	+21	+13
51	46	11	73	20
+13	+22	+61	+ 3	+60
10	10	20	30	20
+10	+20	+20	+20	+40

Objective 4: Express whole numbers in expanded notation and expanded notation as whole numbers.

This objective requires students to express whole numbers in expanded notation and to express expanded notation as whole numbers.

Sample Item

Read the question. Mark your answer.

Which number is 5000 + 600 + 40 + 1?

- ○ 56401
- ○ 5641
- ○ 1465
- ○ 5000641

Test Questions

1. A test item will present either:
   a. a whole number, or
   b. the expanded notation of a whole number.
2. The numbers will be three- or four-digit whole numbers that will not contain zeros.
3. Expanded notation will appear either as words (5 thousands + 6 hundreds + 4 tens + 1 one) or as numbers (5000 + 600 + 40 + 1). The expanded notation will always be in descending order.

Answer Choices

1. Answer choices will be either:
   a. expanded notation when a whole number is presented, or
   b. a whole number when expanded notation is presented.
2. Answer choices expressed in expanded notation will be either words (2 thousands + 1 hundred + 3 tens + 4 ones) or numbers (2000 + 100 + 30 + 4) corresponding to value places in descending order (thousands, hundreds, tens, ones).

3. Incorrect answer choices are likely to result from one of the following types of errors:

   a. Place Holder Error: Failing to drop place-holding zeros when converting from expanded notation to whole numbers.

   b. Reversal Error: Reversing the order of the digits when converting from expanded notation to whole numbers.

   c. Incorrect Value: Assigning digits an incorrect place value when converting from whole numbers to expanded notation.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because there is a place holder error. The zero in 40 should have been dropped when converting from expanded notation to a whole number.

2. The second answer choice is the correct response. All place-holding zeros were dropped and the correct order was retained.

3. The third answer choice is incorrect because the order of the digits was reversed when the expanded notation was converted into a whole number.

4. The fourth answer choice is also incorrect because there is a place holder error. The zeros in 5000 should have been dropped in the whole number.

Instructional Emphases

Mastery of this objective requires an understanding of the concept of place value, that is, the meaning of a digit's placement in a number. You may wish to review the concept of place value by having students represent different numbers by manipulating place value blocks. Then present a place value diagram, such as that presented below.

Whole Number	1000 Thousands	100 Hundreds	10 Tens	1 Ones
6283 →	6	2	8	3
847 →	0	8	4	7
412 →	0	4	1	2
163 →	0	1	6	3
9437 →	9	4	3	7

Express the numbers presented at the left in the place value diagram. Explain why each digit occupies the place it does.

The next step is to introduce the idea of expanded notation. This may be taught by building on the previous instruction as illustrated below.

Whole Number	1000 Thousands	100 Hundreds	10 Tens	1 Ones
6283 →	6	2	8	3

Expanded Notation: 6000 + 200 + 80 + 3

6 thousands + 2 hundreds + 8 tens + 3 ones

Be sure to explain that expanded notation can be written in either words or numbers. (Both will be on the TEAMS test.) Also, have students use the place value diagram to translate numbers expressed in expanded notation to whole numbers.

Possible Instructional Activities

Expanded Practice

Write the following kinds of problems on the chalkboard. As a group activity, have different students fill in the boxes and lines with numbers or words, as specified. Discuss the correct answers with the class as well as any difficulties students encounter.

Whole Number: 6584

1000 Thousands	100 Hundreds	10 Tens	1 Ones
?	?	?	?

Expanded Notation (words) _____ + _____ + _____ + _____

Whole Number: 7593

1000 Thousands	100 Hundreds	10 Tens	1 Ones

Expanded Notation (numbers)

_____ + _____ + _____ + _____

Expanded Notation: 2000 + 100 + 50 + 5

1000 Thousands	100 Hundreds	10 Tens	1 Ones

Whole Number

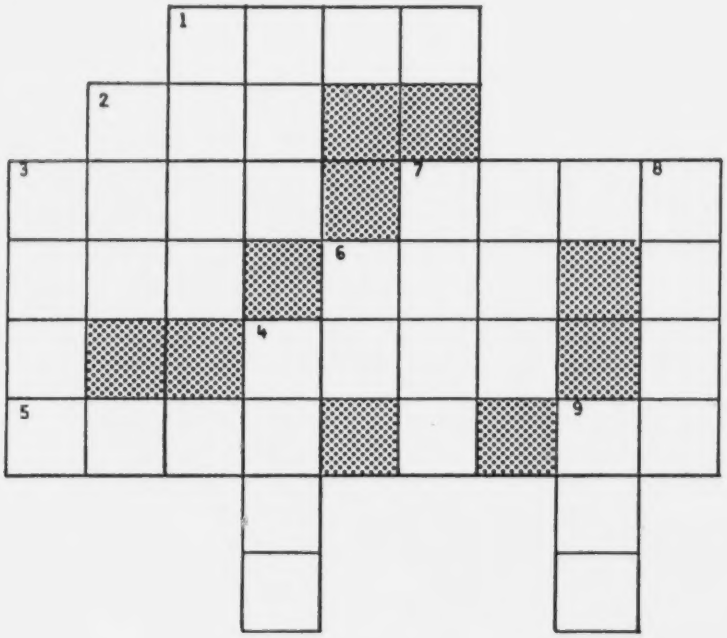
_____

Let's Play Concentration

This is a good exercise for students to work on in pairs or small groups. Write 10 numbers in expanded notation on index cards. Write half of the expanded notation numbers in words, half in numbers. On an additional 10 cards, write the same numbers in standard notation. The rules are as follows: (1) Students shuffle all 20 cards and lay them out facedown in 4 rows by 5 columns. (2) The first player turns over one card and then a second card trying to make a match between the expanded form of a number and its correct answer in standard form. (3) If a match is not made, the cards are turned facedown and the next player continues in similar form. If a match is made, the player making the match collects these cards and takes another turn. That player can continue as long as a match is made each turn. (4) The game ends when all matches have been made. The winner of the game is the player who makes the most matches. Emphasize to students that this game requires concentration. They should try to remember the location of the exposed, but unmatched cards in order to make more matches later in the game.

Cross Number Puzzle

Copy the puzzle below and distribute it to students for further practice with expanded notation of whole numbers.



Across

(1) 6000 + 500 + 40 + 2
(2) 3 hundreds + 1 ten + 8 ones
(3) 4000 + 600 + 80 + 9
(4) 1000 + 600 + 40 + 5
(5) 3 thousands + 4 hundreds + 2 tens + 7 ones
(6) 3 hundreds + 2 tens + 1 one
(7) 5000 + 600 + 30 + 8
(9) 1 ten + 3 ones

Down

(1) 6 thousands + 1 hundred + 8 tens + 3 ones
(2) 300 + 60 + 9
(3) 4 thousands + 7 hundreds + 1 ten + 3 ones
(4) 1000 + 700 + 50 + 6
(6) 3 tens + 6 ones
(7) 5 thousands + 2 hundreds + 4 tens + 6 ones
(8) 8 thousands + 1 hundred + 9 tens + 3 ones
(9) 100 + 20 + 4

Objective 5: Use pictorial models to identify fractional parts of a whole or of a group of like objects.

This objective requires students to identify fractional parts of either a whole or of a group of like objects in pictorial representations.

Sample Item

Read the question. Mark your answer.

What part of this set of cups is shaded?

○ $\frac{1}{3}$

○ $\frac{1}{4}$

○ $\frac{2}{3}$

○ $\frac{3}{4}$

Test Questions

1. The fractional parts to be identified will be limited to $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, and $\frac{3}{4}$.
2. All parts of wholes will be of equal size and shape; all elements in a set will be identical. Sets will consist of no more than four elements.
3. An item will require one of the following four tasks:
   a. Identify the fraction that corresponds to the shaded part of a whole.
   b. Identify the fraction that corresponds to the shaded part of a set.
   c. Given a fraction, identify the appropriately shaded part of a whole.
   d. Given a fraction, identify the appropriately shaded part of a set.

Answer Choices

1. All elements of a pictorial set will be identical; all divided parts of a whole will be of equal size and shape.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Counting Error: An error in counting the number of elements in a set or the number of parts of a whole.

   b. Incorrect Fractional Set-Up: An error in setting up a fraction. For example, identifying the following shaded part as $\frac{1}{2}$ by incorrectly setting up the fraction as the number of shaded parts over the number of unshaded parts.

   c. Fractional Complement Error: Identifying the complement of the correct fraction as the appropriate response. For example, identifying the following shaded part as $\frac{2}{3}$. The response $\frac{2}{3}$ is the complement of the correct response $\frac{1}{3}$, and corresponds to the number of unshaded parts in the figure.

Answer Analysis for Sample Item

1. The first answer choice represents an incorrect fractional set-up. The response, $\frac{1}{3}$, could be obtained by setting up the fraction as the number of shaded cups over the number of unshaded cups.

2. The second answer choice is correct. One of the four cups presented is shaded. Therefore, the correct answer is $\frac{1}{4}$.

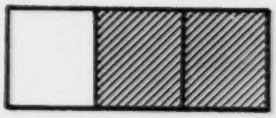
3. The third answer choice is incorrect and could be obtained through a combination of errors. The answer $\frac{2}{3}$ may be the result of a counting error and incorrect fractional set up.

4. The fourth answer choice is incorrect because of a fractional complement error. The fraction $\frac{3}{4}$ represents the cups in the set that are not shaded. However, the item asks for the cups in the set that are shaded.

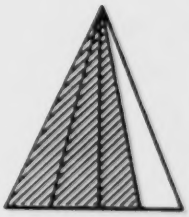
Instructional Emphases

Understanding fractions can present a challenge for young students. Begin by explaining to students that in everyday life, fractions are used to describe parts of an object or set. Draw basic geometric shapes on the board as illustrated below or use tagboard to show fractional parts superimposed on the whole. Show students that a part of each object is shaded, and tell them that a fraction can describe the shaded part.

($\frac{1}{2}$)



($\frac{2}{3}$)



($\frac{3}{4}$)

For each shape have students tell you both the number of parts shaded and the total number of parts. Show them that a fraction is set up by placing the number of shaded (or otherwise identified) parts over the total number of parts. Then, write the fractions below each shape.

You may also want to demonstrate the concept of fractions using sets of like objects such as similarly shaped blocks. For example, show the students three red blocks and one green block. Explain to students that in this set $\frac{3}{4}$ of the blocks are red and $\frac{1}{4}$ are green. Vary the number of blocks in the set in order to represent different fractions.

Provide ample review and opportunities for practice with both pictorial and concrete models. Encourage students to draw pictures or use manipulatives to help them solve fraction problems. Introducing the terms "numerator" and "denominator" may be appropriate at this point. Be sure that students grasp the distinction between the functions of the numerator and the denominator in setting up fractions.

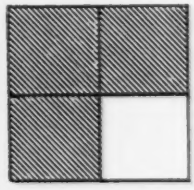
Possible Instructional Activities

Slice a Fraction

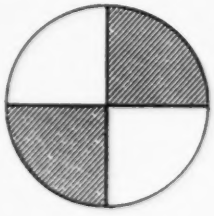
Ask for two volunteers to join you at the front of the class. Cut a large apple into halves and give a piece to each volunteer. Ask the class how much of the apple each volunteer has. After the correct answer ($\frac{1}{2}$) has been identified and discussed, take back the two apple slices and cut them in halves. Give three of the four resulting slices to the first volunteer and the remaining slice to the other volunteer. Ask the class how much of the apple each volunteer now has. Slice another apple to represent thirds. Continue this activity until students appear to grasp the concept of fractional parts.

Two of a Kind

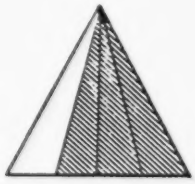
Present sets of three different geometric shapes either on the chalkboard or on handouts. Within each set, the shapes should be divided into the same number of equivalent parts. For two of the shapes, show shading for the same fraction (for example, $\frac{3}{4}$). In the third shape, shade in a fractional proportion that is not the same as the other two. Have students circle the shape whose shading is different than the other two. Also, have students identify the fraction for each shape. For example:



$\frac{?}{?}$



$\frac{?}{?}$



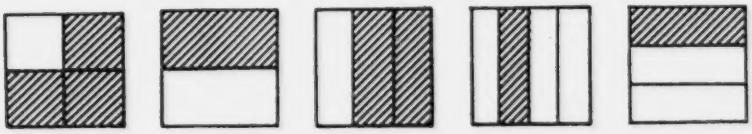
$\frac{?}{?}$

Fraction Find

Present to the class, on poster boards or on the chalkboard, sets containing five equivalent geometric shapes. Label the shapes A through E. Divide one shape into halves,

two others into thirds, and the remaining two into fourths. Shade in parts of all five shapes so that each represents one of the following fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, and $\frac{3}{4}$, as shown below.

A B C D E

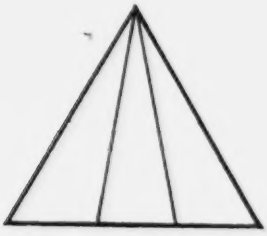


You may wish to use different colors to shade in the fractional proportion for each shape. For each set, ask for volunteers to identify the fraction that each diagram represents.

Color a Fraction

Give students a handout such as the following. Tell them to color parts of shapes or elements in a set to make a fraction. Then have students exchange papers and identify the fractions that are shown.

1. fraction = _____

2.  fraction = _____

3. fraction = _____

4. fraction = _____

5. fraction: _____

This activity can also be used "in reverse" by giving students the models and specifying a fraction for each. In that case, tell students to color the model to match the specified fraction.

SKILL AREA: COMPUTATION

The skill area of computation includes two objectives that require addition and subtraction of whole numbers, with or without regrouping.

Objective 6: Add whole numbers having as many as three digit, with or without regrouping.

This objective requires students to solve addition problems involving whole numbers.

Sample Item

Work the problem. Mark your answer.

$$\begin{array}{r} 406 \\ +\ 57 \\ \hline \end{array}$$

- ○ 453
- ○ 465
- ○ 463
- ○ 563

Test Questions

1. A test item will require students to solve addition problems with either two or three addends. Some of the problems will involve one regrouping.
2. Problems will be presented in vertical format.
3. The addends will be whole numbers between 10 and 999.

Answer Choices

1. The correct answer choice will be the exact solution to the addition problem presented.
2. Incorrect answer choices are likely to result from one or both of the following types of errors:

a. Computation Error: An error in the addition of numbers.

b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because there is a regrouping error. The answer choice reflects a failure to regroup in the tens column.

2. The second answer choice is incorrect because there is a computation error. The number 15 was obtained for the sum of 6 plus 7 rather than the correct sum, 13.

3. The third answer choice is the correct response. The addition was performed accurately as illustrated.

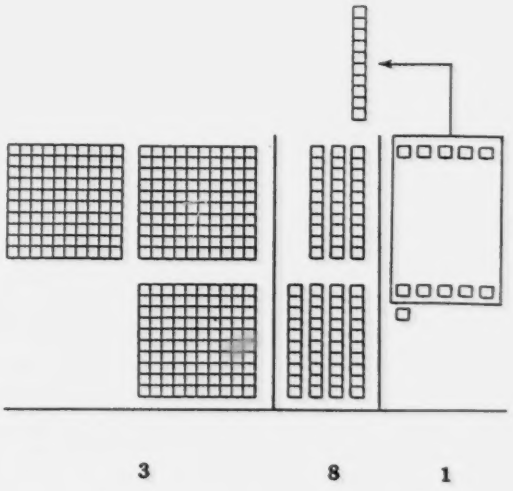
$$\begin{array}{r} {\scriptstyle 1} \\ 406 \\ +\ 57 \\ \hline 463 \end{array}$$

4. The fourth answer choice is incorrect because there is a regrouping error. Unnecessary regrouping was performed in the hundreds column to obtain 5 instead of 4.

Instructional Emphases

In order to master this skill, students need to understand basic addition and place value concepts. They must learn to add each place column starting with the ones place at the right and moving to the left. Thus, you may want to review the concept of place value with students. Another important skill required for this objective is regrouping. Students should recognize that when there are 10 or more in a place, they must regroup. Regrouping to the next place can be illustrated with blocks as shown in the addition problem on the next page.

$$\begin{array}{r} {\scriptstyle 1} \\ 235 \\ +\ 146 \\ \hline 381 \end{array} =$$



When presenting addition of two- and three-digit numbers to students, a step-by-step approach such as that outlined below may be helpful.

Sample problem:

$$\begin{array}{r} 173 \\ +\ 43 \\ \hline \end{array}$$

Step 1

$$\begin{array}{r} 1\ 7\ 3 \\ +\ \ 4\ 3 \\ \hline 6 \end{array}$$

Add ones. 3 ones + 3 ones = 6 ones
Is the sum 10 or more? No.
Write 6 in the ones place.

Step 2

$$\begin{array}{r} 1\ 7\ 3 \\ +\ \ 4\ 3 \\ \hline 6 \end{array}$$

Add tens.
7 tens + 4 tens = 11 tens
Is the sum 10 or more tens? Yes.

Step 3

$$\begin{array}{r} {\scriptstyle 1} \\ 1\ 7\ 3 \\ +\ \ 4\ 3 \\ \hline 1\ 6 \end{array}$$

11 tens

Regroup 11 tens as 1 hundred and 1 ten.
Write 1 in the tens place.
Write 1 in the hundreds place on top of the other numbers already there.

$$\begin{array}{r} {\scriptstyle 1} \\ 1\ 7\ 3 \\ +\ \ 4\ 3 \\ \hline 2\ 1\ 6 \end{array}$$

Step 4

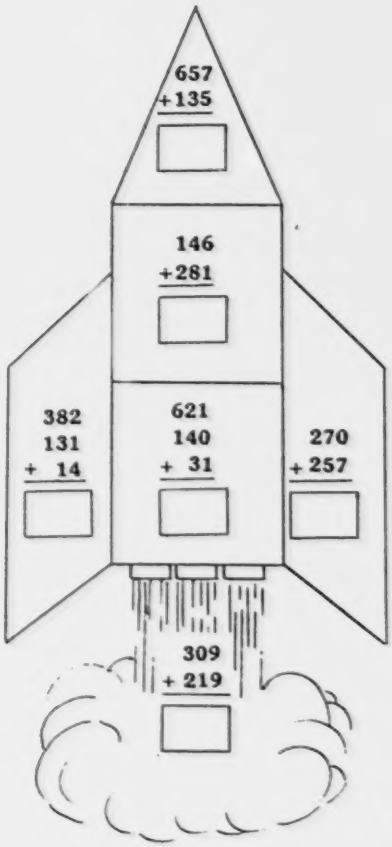
Add hundreds.
1 hundred + 1 hundred = 2 hundreds
Write 2 in the hundreds place.

Possible Instructional Activities

Rocket in Color

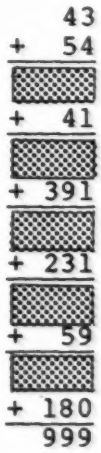
Provide each student with a copy of the rocket shown below. Students should solve the addition problem presented in each section of the rocket. Below the rocket is an answer key that contains the correct answers to the problems. Tell students that they must determine the correct answer for each section of the rocket. Then, students are to color each section of the rocket as indicated in the answer key.

Answer		Color
427	=	red
527	=	blue
528	=	orange
792	=	purple



Addition Series

Give students a problem set to solve such as the one presented below. Direct students to fill in the blanks by performing the specified addition operation. Explain to them that the answer they obtain in the first problem becomes an addend in the next problem, and so on. If the computations are performed correctly, the students should obtain the final answer shown.



Addition Relay

Divide the class into two or three teams for a relay game involving addition problems. Write a different set of addition problems on the board for each team to solve. The players on each team must go to the board one by one and solve a problem as fast as they can. The team who finishes first with the fewest mistakes wins.

Objective 7: Subtract whole numbers having as many as three digits, with or without regrouping.

This objective requires students to solve subtraction problems involving whole numbers.

Sample Item

Work the problem. Mark your answer.

$$\begin{array}{r} 175 \\ -\ 66 \\ \hline \end{array}$$

○ 119

○ 109

○ 107

○ 19

Test Questions

1. Numbers will be whole numbers between 10 and 999.

2. Problems will be presented in vertical format with one minuend and one subtrahend. There will be no more than one zero in any test item.

3. Items will require either one regrouping or no regrouping.

Answer Choices

1. The correct answer choice will be the exact solution to the subtraction problem presented.

2. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in the subtraction of two numbers.

   b. Regrouping Error: Failing to regroup when necessary, regrouping incorrectly, or regrouping unnecessarily.

   c. Place Value Error: Failure to retain the place value of zero.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because there is a regrouping error, as illustrated. After regrouping from the tens place to the ones place, the 7 in 175 was not reduced to 6.

$$\begin{array}{r} 1 \\ 175 \\ -\ 66 \\ \hline 119 \end{array}$$

2. The second answer choice is the correct response, as illustrated. All computations are accurate and the regrouping is correctly performed.

$$\begin{array}{r} 6 \\ 175 \\ -\ 66 \\ \hline 109 \end{array}$$

3. The third answer choice is incorrect because there is a computation error, as illustrated. The 6 was subtracted from 15, yielding 7 rather than 9.

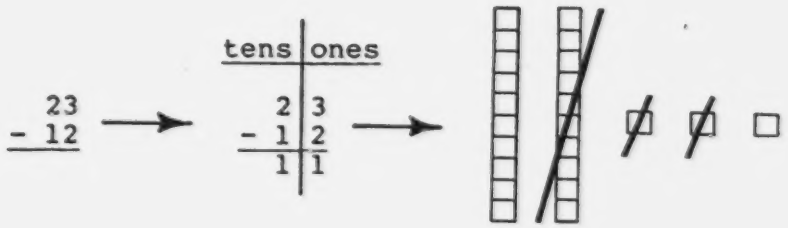
$$\begin{array}{r} 175 \\ -\ 66 \\ \hline 107 \end{array}$$

4. The fourth answer choice is incorrect because of a failure to retain the place value of 0. The 0 was dropped from the solution to yield the incorrect answer 19.

Instructional Emphases

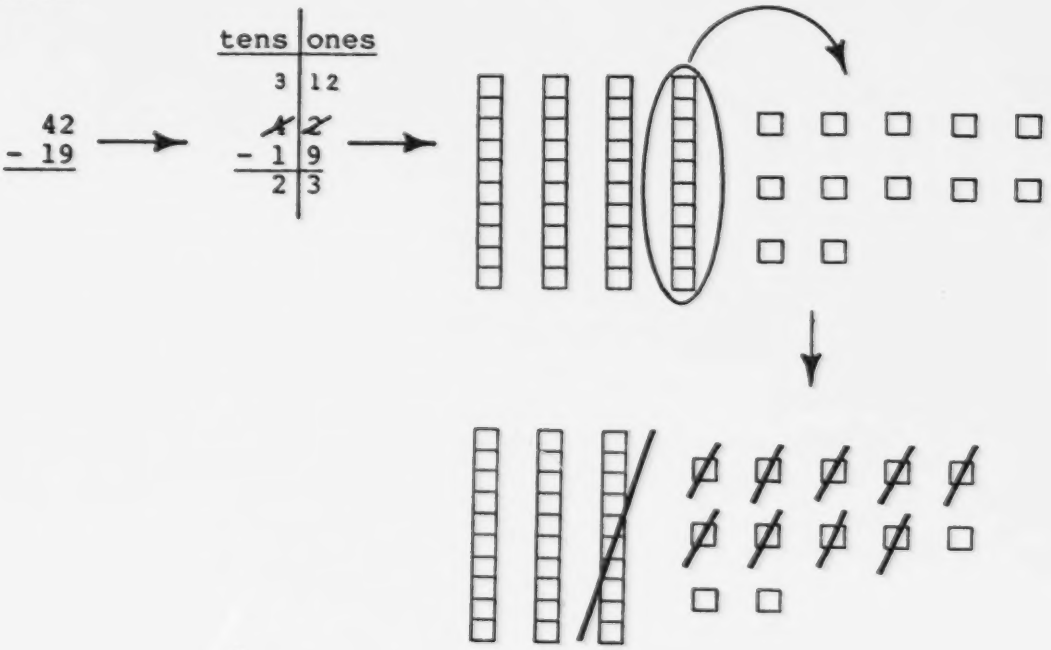
Review the meaning of subtraction with students. Point out that subtraction tells the difference between two numbers or, in more concrete terms, it tells how many are left after some number of objects are taken away from a given set. You may want to reinforce the concept of subtraction using objects. For example, you could physically demonstrate that taking two pencils from a set of five pencils leaves you with three pencils. Make sure that students have mastered subtraction with one-digit numbers. Flashcards are helpful for practice and to test for mastery.

After reviewing subtraction with one-digit numbers, proceed to two-digit and three-digit numbers. You can illustrate the subtraction process using place value models, as illustrated below.



Start with sets of numbers that do not require regrouping. Be sure that students understand they are to align the digits in the ones and tens columns.

The final step in mastering subtraction is understanding the regrouping process. You can discuss regrouping by using subtraction examples. This can be accomplished by presenting subtraction problems within the place value framework, as illustrated.



Finally, show students how to check their subtraction by adding.

Possible Instructional Activities

Subtract in Words

Present the following problems for students to complete. Tell them to solve the subtraction problems and then look up each answer in the key shown below. Students then fill in the blank line below each problem with the letter that corresponds to their answer. If the problems were solved correctly the letters should form a secret message.

	567 - 24 = ☐	87 - 19 = ☐	683 - 139 = ☐	249 - 36 = ☐
Letter:	___	___	___	___

	453 - 312 = ☐	974 - 156 = ☐
Letter:	___	___

	863 - 35 = ☐	93 - 14 = ☐	567 - 347 = ☐	119 - 51 = ☐	688 - 144 = ☐
Letter:	___	___	___	___	___

Key

A - 68	H - 213	R - 79
E - 220	I - 141	S - 818
G - 828	M - 543	T - 544

Calculated Risks

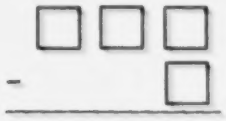
Have each player write the following on a piece of paper.

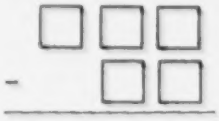
$$\square\square - \square = ___$$

Pick 3 single-digit numbers and read them aloud slowly. As each number is read, students should enter it in one of

the three boxes. Once a number has been written in a box, it cannot be changed. Each student subtracts the resulting whole numbers. The student who gets the largest (or smallest) answer is the winner.

Repeat the process using other frameworks as shown below.


(Read aloud 4 single-digit numbers)


(Read aloud 5 single-digit numbers)

Subtraction Fill-In

Present the following problems to students. For each problem, have students fill in the blank with the appropriate digit. To successfully solve for the missing digit in these problems, students must use addition. This activity is intended to reinforce the concept that addition and subtraction are inverse operations.

29	87	538	937	876
- □	- □	- □4	-□25	- 41□
26	81	514	312	462
7□	1□	8□5	□73	□86
- 6	- 3	- 70	- 512	- 72
72	13	825	261	914

SKILL AREA: PROBLEM SOLVING

The skill area of problem solving covers two objectives: one-step word problems using addition and one-step word problems using subtraction.

Objective 8: Solve one-step word problems involving addition of whole numbers.

This objective requires students to read and solve word problems involving the addition of no more than three whole numbers.

Sample Item

Solve. Mark your answer.

On the way to school Miguel counted 25 blue cars, 12 red cars, and 2 yellow cars. How many cars did Miguel count?

- ⬭ 25 cars
- ⬭ 39 cars
- ⬭ 38 cars
- ⬭ 27 cars

Test Questions

1. A test item will present a word problem whose solution requires one operation involving addition. All numbers will be whole numbers between 1 and 99 with no more than three addends per problem. No regrouping will be required to solve the problem.
2. No irrelevant numbers will be included in the items.
3. No problems will involve money or age.
4. Each word problem will consist of two, three, or four sentences, with the total number of words not to exceed 30.

Answer Choices

1. Units will be specified for each answer choice.

2. The correct answer choice will be the exact solution to the problem presented.

3. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in addition.

   b. Missing Operation: Not operating on the data.

   c. Incorrect Operation: Performing an operation other than the required one.

   d. Incomplete Operation: Failing to use all the data necessary to perform an operation.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because there is a missing operation. The first number in the problem is selected as the answer and no addition is performed.

2. The second answer choice is the correct response as illustrated below:

```
  25 cars
  12 cars
+  2 cars
  39 cars
```

3. The third answer choice is incorrect because there is a computation error. It appears that the numbers in the ones column are added incorrectly to obtain 8 instead of 9.

4. The fourth answer choice is incorrect because there is an incomplete operation. The number of red cars is not included in the operation as illustrated below:

```
(error)   25
        + 2
          27 cars
```

Instructional Emphases

In introducing this objective, demonstrate how to solve word problems by working through a few problems as the class observes. Use word problems such as the following:

> Geraldine has 7 pencils. Tom gave her 6 more pencils. How many pencils does Geraldine have now?

Show students that a word problem must be read carefully in order to determine what information is requested. Because the sample problem above specifies the joining of two amounts, addition is required. Have two students "act out" this word problem for the class. That is, the two students should stand up in front of the class and demonstrate the exchange of pencils. As demonstrated in the acting, the number sentence which correctly represents this situation is "7 + 6." Perform the computation, emphasizing to students that it is important to both examine the answer to make sure that it seems reasonable and repeat the computation as a check on accuracy.

Work through several word problems with the class using the problem-solving steps listed below. Then, give students some word problems to work through individually. You may want to present students with a copy of this problem-solving plan to use as they solve each problem.

1. Read the problem.

   Read the problem carefully. Pay close attention to what the question asks you to do.

2. Locate all the numerical information.

   Decide how each number should be used to compute the answer.

3. Decide what operation is required.

   Identify the number sentence that fits the situation.

4. Perform the arithmetic.

   Make sure that all the numbers in the problem are used correctly.

5. Check for accuracy.

   Check the answer to see whether it makes sense. Repeat the arithmetic to be sure that it is correct.

Possible Instructional Activities

Fill in the Blanks

On the board, write a word problem with blanks to be replaced with names of people, kinds of objects, or types of animals. The following is an example of such a problem:

[Name 1] went to the store and bought 15 [object 1]. His sister [name 2] already had 2 [object 1] and got 2 more from her friend [name 2]. How many [object 1] did they have in all?

Ask different students to complete the blanks. When the blanks are filled in, read the problem aloud and ask students to solve it individually. Have one student demonstrate the solution to the class.

Challenging Problems

Tell your students that you can make a word problem out of anything they name in the classroom, but they must solve the problem you create. Let students raise their hands and name objects (for example, desks, pencils, chalk) or even locations (for example, the ceiling, the door). Create a simple word problem with two or three addends. You may be able to enliven the activity by creating humorous situations involving you or the students. For example, if a student were to ask for a word problem about chairs, you could reply with "Yesterday, Alex fell off his chair 18 times, Anita fell off her chair 10 times, and I fell off my chair only 1 time. How many times did people in our class fall off their chairs yesterday?" Students raise their hands to provide the correct answer. Before doing the next problem, write the correct calculation on the board with the appropriate unit labels.

Fun at the Zoo

Present stories such as the following to students. Have students answer the questions posed by carefully reading the problems and then writing and solving a number sentence that fits the situation.

Last Saturday Jessica and Christopher went to the zoo.

1. They counted 26 big monkeys and 12 little monkeys in one area. How many monkeys did they see? _____

2. In one cage they saw 5 blue birds, 11 red birds, and 12 green birds. How many birds did they see in the cage? _____

3. Jessica petted 13 baby goats and 15 baby rabbits. How many animals did she pet in all? _____

4. At the zoo Jessica and Christopher walked 3 kilometers in the morning and 4 kilometers in the afternoon. How many kilometers did they walk in all? _____

Objective 9: Solve one-step word problems involving subtraction of whole numbers.

This objective requires students to read and solve one-step word problems involving subtraction.

Sample Item

Solve. Mark your answer.

Karen and John were making cookies. Karen made 37 cookies. John made 59 cookies. How many more cookies did John make than Karen?

- ○ 32 cookies
- ○ 59 cookies
- ○ 22 cookies
- ○ 96 cookies

Test Questions

1. A test item will present a word problem requiring one subtraction operation. All the numbers will be whole numbers between 1 and 99. Each problem will have one minuend and one subtrahend. No regrouping will be required to solve the problem.
2. No extraneous data will be included in any item.
3. No problems will involve money or age.
4. A problem will consist of two, three, or four sentences, with the total number of words not to exceed 30.

Answer Choices

1. Units will be specified for each answer choice.
2. The correct answer choice will be the exact solution to the problem presented.
3. Incorrect answer choices are likely to result from one or more of the following types of errors:

   a. Computation Error: An error in subtraction.

b. Missing Operation: Not operating on the data.

c. Incorrect Operation: Performing an operation other than the required one.

Answer Analysis for Sample Item

1. The first answer choice is incorrect because of a computation error in the tens place. The difference of 5 minus 3 is 2, not 3.

2. The second answer choice is incorrect because no operation is performed. One of the numbers from the problem is selected as the answer.

3. The third answer choice is the correct response. The subtraction is performed correctly, as illustrated below:

$$\begin{array}{r} 59 \\ -\ 37 \\ \hline 22 \end{array}$$

4. The fourth answer choice is incorrect because of the use of an incorrect operation. Choice D is arrived at by adding, rather than subtracting, as illustrated below:

(error)
$$\begin{array}{r} 59 \\ +\ 37 \\ \hline 96 \end{array}$$

Instructional Emphases

The essential skill in solving word problems is recognizing how to translate the word problem into the appropriate mathematical operation. To help students master this skill, you may want to review the step-by-step procedure for solving word problems as presented in the Instructional Emphases of Objective 8. Also, present some word problems for the class to work through together using the step-by-step procedure.

At this grade level, successful translation of word problems to mathematical sentences requires that students learn to recognize whether a problem calls for addition or subtraction. The activities suggested in the following section are designed to help students determine what operation a word problem requires. Activities that focus on performing word problem computations are presented for Objective 8. These activities can be easily adapted for subtraction and should be used in conjunction with the instructional activities that follow.

Possible Instructional Activities

Question Clues

In some cases students can decide what operation is necessary by studying the question asked in the problem. Give students a handout containing questions typical of word problems. Include questions that require subtraction (for example, How many turtles were left? or, How many more birds are there than turtles?). Other questions should be typical of addition problems (for example, How many fish were there in all?) A third type should give no clue (for example, How many birds were in the cage? or, How many turtles are there now?)

Have students put a +, - or ? symbol next to each sentence to show whether the sentence requires an addition or subtraction operation, or whether the operation required is not specified.

It's All in a Word

Give students word problems in which they circle one of two words that indicate whether addition or subtraction is required. Then have students solve the problem they "created." Discuss the problems in class.

> Archie has 13 records. He [broke/bought] 6 records. How many records does Archie have now?
>
> Maria has 15 pens. She [found/gave away] 12 pens. How many pens does Maria have now?
>
> There are 25 cookies in the cookie jar. Marta [baked/ate] 12 cookies. How many cookies are there now?

Plus or Minus

Write the following word problems on the chalkboard. Each problem has two questions: one requiring addition, the other requiring subtraction. For each question, ask different students to come to the board and indicate whether the solution requires addition (+) or subtraction (-) and why.

1. Arthur has 12 toy trucks and Roger has 6 toy trucks.

   a. How many more trucks does Arthur have than Roger? _____

b. How many toy trucks do they have? _____

2. Phillip saw 7 butterflies yesterday and 9 butterflies today.

   a. How many butterflies did Phillip see? _____

   b. How many more butterflies did Phillip see today than yesterday? _____

3. Kathleen has 24 baseball cards.

   a. How many cards would Kathleen have if she bought 12 more cards? _____

   b. How many cards would Kathleen have if she gave away 12 cards? _____

SKILL AREA: MEASUREMENT

Objective 10: Select the unit of measure used to determine length, weight/mass, or capacity/volume.

This objective requires students to decide what unit of measure would be most appropriate for measuring a specified dimension of an object.

Sample Item

Read the question. Mark your answer.

The length of a football field is usually measured in

- ○ gallons
- ○ yards
- ○ quarts
- ○ pounds

Test Questions

1. A test question will identify an object and name the dimension of the object that is to be measured (for example, length, weight, volume).

2. Some of the test items will show a picture of the object to be measured.

3. The items will include the following types of dimensions of an object: length, weight/mass, and capacity/volume.

Answer Choices

1. All answer choices will be labeled in either customary or metric units. Customary and metric units will not appear in the same set of answer choices.

2. The eligible units are as follows:

CUSTOMARY	METRIC
Length	
inch	centimeter
foot	meter
yard	kilometer
Weight/Mass	
pound	gram
	kilogram
Capacity/Volume	
pint	liter
quart	
gallon	

3. No unit names will be abbreviated.

4. The correct answer choice will be the unit of measure that is most commonly used to measure the identified object.

5. Incorrect answer choices will result from one of two types of errors:

   a. identification of a property or dimension of an object other than the one requested in the item (for example, grams when length was requested); or

   b. identification of a unit of measure that is a possible but not a usual way of measuring a property (for example, kilometers to measure the length of a pin).

Answer Choice Analysis for Sample Item

1. The first answer choice is incorrect because gallons cannot be used to measure length.

2. The second answer choice is the correct response. The length of a football field is appropriately measured in yards.

3. The third answer choice is incorrect because quarts cannot be used to measure length.

4. The fourth answer is incorrect because pounds cannot be used to measure length.

Instructional Emphases

Students must learn three skills in order to master this objective. First, they must learn which units of measure are used to measure a given property. Thus, they need to learn that feet and meters measure length whereas pounds and kilograms measure weight, and so on. Second, they need to learn which unit is appropriate for a given measuring task. For example, although milliliters and liters both measure volume, only milliliters are the appropriate unit for measuring the capacity of an eyedropper.

After being told which units are used to measure various objects, students begin to develop an internal sense of the relative sizes of the measurement units. This knowledge allows students to make measurement judgments. However, students need sufficient practice with measurement problems to develop fully their measurement sense and their ability to make judgments about the appropriate metric and customary units for measuring the properties of objects. Finally, students need to become familiar with the units of measure on both metric and customary scales.

Possible Instructional Activities

One Object, Many Units

Have students name a familiar object that has many parts. Some objects that will work include a person, a car, and a house. While the students name as many parts of the object as they can, you should write their suggestions on the chalkboard. Then make three columns parallel to the list of parts. Label them length, weight, and volume. Underneath each column write two subheadings, metric and customary. Suppose the classroom was identified as the object of interest, and students named parts of the classroom to be measured. The board would then look like this:

Classroom	LENGTH metric/customary	WEIGHT metric/customary	VOLUME metric/customary
chalkboard eraser			
book			
fish tank			
pencil			
bookcase			

For each part on the list, ask students whether that object could be measured for a particular property (length, weight, height) and if so, what unit(s) would be appropriate for measuring each property. Fill in the chart as you go. Then, you may wish to have students measure the objects listed on the chart.

Measured Differences

Create a list of objects that can be measured. Include a variety of objects so that all three properties (weight, length, volume) can be measured in different units. Try to have some objects that are measurable on two or three dimensions (for example, weight and length or weight and volume). For each object on the list, ask a volunteer to name a property that could be measured. Ask for another volunteer to specify the appropriate units to measure that property. For example, if "weight" is given as the property, the next student must specify the unit (for example, pound, gram or kilogram). Once both answers have been provided, you can either ask a student to name another dimension of the object (for example, length) or specify a new object.

School by Rule

Divide the class into small groups or pairs of students. Distribute a handout that contains several statements specifying a property and a unit of measurement. Examples include: length in inches, weight in tons, volume in gallons, length in meters, weight in grams, and volume in milliliters. Statements involving metric units should be on the opposite side of the page from those involving customary units. Under each statement, supply lines for students to write in the names of three things that can be measured according to the property and unit specified. Include some impossible measurement statements such as "length in kilograms." Warn students about the possibility of including impossible measurement statements on the handout. Tell them to mark these statements with an "X."

SKILL AREA: GEOMETRY

This skill area involves one objective, namely, identifying pictorial models of geometric shapes.

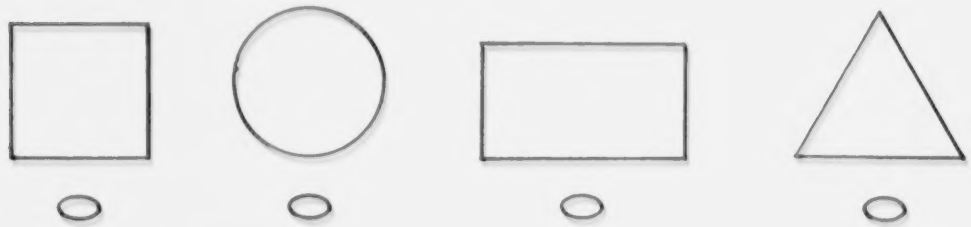
Objective 11: Identify pictorial models of two- and three-dimensional shapes.

This objective requires students to identify geometric shapes.

Sample Item

Read the problem. Mark your answer.

Which picture below is a circle?



Test Questions

1. A test item will ask students to identify a particular geometric shape.

2. Eligible two-dimensional figures will be circles, squares, rectangles, and triangles.

3. Eligible three-dimensional figures will be cubes, spheres, cylinders, and cones.

3. Three-dimensional figures will be drawn with dashed lines to represent hidden edges.

4. Test items will take one of two possible forms:

   a. a two- or three-dimensional figure with the name of the figure to be identified, or

   b. the name of a two- or three-dimensional figure with the figure to be identified.

Answer Choices

1. The correct answer will be the picture or name of a requested figure.

2. No set of answer choices will include both two- and three-dimensional figures of the same shape (for example, a circle and a sphere will not appear in the same item).

3. Incorrect answer choices will be any figure or name other than the one requested (for example, circle or octagon when a square is requested).

Answer Analysis for Sample Item

1. The first answer choice is incorrect because it depicts a square.

2. The second answer choice is correct. It depicts a circle, which is the requested shape.

3. The third answer choice is incorrect because it depicts a rectangle.

4. The fourth answer choice is incorrect because it depicts a triangle.

Instructional Emphases

Mastery of this objective requires that students be able to distinguish among the basic geometric shapes and that they know the names of these figures. At this grade level, most students are already familiar with two-dimensional shapes. Therefore, a brief review of the basic two-dimensional geometric shapes may be sufficient. You may want to spend more time introducing the three-dimensional shapes and stressing the difference between two- and three-dimensional shapes (for example, the difference between a square and a cube).

Provide students with opportunities to work with geometric shapes. Bring in actual objects in the shape of basic geometric figures for students to examine and handle. Have students practice drawing these shapes. It is important that students understand the meaning of the "dashed line" in depicting three-dimensional objects (for example,).

Possible Instructional Activities

Which Shape Is It?

Place various kinds of two- and three-dimensional geometric shapes in a bag. Have a student come to the front of the class and select a shape from the bag without looking. The student should handle the shape and try to guess what it is. Repeat in small groups until all students get a turn.

Match 'em Up

Give each student a set of flashcards depicting the following geometric shapes: circle, square, rectangle, triangle, cube, sphere, cylinder, and cone. Then, write the name of a geometric shape on the chalkboard. Tell students to find the matching flashcard from their set and hold it up. Alternatively, point to classroom objects and ask students to find the picture of the geometric shape that matches the object (for example, a piece of chalk or a basketball).

Shape Search

This game challenges students to find classroom objects in the shapes of geometric figures. Start the game by telling students "I am thinking of something. It is in the shape of a [geometric shape]." Let students ask "yes-no" questions (for example, Is it green?; Is it bigger than a basketball?) until they guess the object. If students guess objects that are not of the specified shape, stop to discuss the name and characteristics of the incorrect shape. The object in question should be clearly visible to students sitting anywhere in the classroom.